Electrophysiology leech giant salivary cells

SIR—We note that our description[1] of the electrophysiology of leech giant salivary cells has been echoed by Jones *et al.* in a recent letter to *Nature*[2]. Attention has again been drawn to the possible experimental utility of the cells in studying cellular secretion, but in spite of its title, the letter does not present a study of excitation–secretion coupling. The authors suggest that it should be possible to investigate the release of identified secretions from each of the five types of salivary cell, in the way that serotonin release from the giant cerebral neurones of *Aplysia* has been studied[3].

Although the lack of electrical coupling between the salivary cells facilitates study of their membrane properties, a number of problems confront an investigation of the release of identified secretions at the level of the single gland cell. Since no acinar or duct structure is present, it seems likely that the various secretions are formed entirely by exocytosis, without an accompanying volume of solvent. The collection and assay of such small volumes of concentrated product from a single cell will require both the site of discharge and biochemical nature of the secretion to be known while electrical activity is monitored. However, unlike identified neurones in invertebrate ganglia, the histochemical types of salivary cell do not appear to be identifiable either on the basis of stereotyped position and size of their cell bodies within the gland, or by characteristic forms of the action potential. As an alternative to biochemical assay of the product, direct observation of secretory events at the ductule terminal of a single cell is a tantalizing possibility.

Using immunohistochemical methods, we have observed paired nerve fibres with a positive reaction to anti-serotonin antibody originating at the sub-oesophageal ganglion and running along the length of the proboscis sheath to enter the anterior salivary glands at the proboscis base. These axons have multiple branching points and conspicuous varicosities, and are likely to be the stomatogastric nerves[4]. Although we have not resolved contacts with individual salivary cells, neuronal serotonin is clearly present in their vicinity, and is probably one of the natural stimuli for excitation, as suggested in the recent letter.

The establishment by Sawyer[2] of a facility for breeding *Haementeria* is greatly to be welcomed, and should allow development of the potential of the salivary gland system, which by now has been very amply stated.

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1. Marshall, C.G. & Lent, C.M. *J. exp. Biol.* **113**, 367–380 (1984).
2. Jones P.G., Sawyer, R.T. & Berry, M.S. *Nature* **315**, 679–680 (1985).
3. Gerschenfeld, H.M., Hamon, M. & Paupardin-Tritsch, D. *J. Physiol., Lond.* **274**, 265–278 (1978).
4. Sawyer, R.T., Damas, D. & Tomic, M. *Archs. Zool. exp. gen.* **122**, 411–425 (1982).

An avian water-repellent proposed

SIR—Bird droppings recently fell onto the roof of my car and overnight there was a very heavy downfall of rain. In the morning, I noticed that although the roof of the car was covered by rain droplets, an area of about nine inches radius around the bird droppings was completely dry.

As the photograph shows, the appearances resemble the inhibitory zone seen on bacterial plates around antibiotic impregnated disks.

It is possible, therefore, that birds have in their bodies a substance with powerful water-repellent properties and that some of the excess of this is excreted in their faeces.

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A North London car roof betrays water-repelling activity.

Symmetry-coded cells in the visual cortex?

SIR—In their comment[1] concerning our recent findings on compound grating discrimination[2], Livingstone and Hubel argued against the Fourier-analysis theory of cortical function and proposed an explanation of our data in terms of known receptive field properties of cortical cells. We believe that their interpretation is consistent with what we were saying, but that our results are not fully covered by current physiological knowledge. Thus we suggest that it would be useful to investigate whether "symmetry-opponent" cells exist in visual cortex. Such neurones might constitute the missing link in Livingstone and Hubel's physiological interpretation of our psychophysical observations. Alternatively, new concepts to explain visual pattern analysis need to be considered.

Descriptions of the stimuli themselves do not explain vision. This has been pointed out by Watt[3] in his commentary on our study. In this sense we used Fourier terminology for precisely characterizing our stimulus patterns, but we did not imply that a multi-channel model of spatial frequency analysis is adequate for explaining early visual processing in pattern discrimination. Rather, our experimental results led us to conclude that compound grating discrimination can neither be related to narrow-band spatial frequency channels nor to the visual encoding of spatial phase. With these two assumptions being rejected, there was little left to support a global Fourier-analysis theory of compound grating discrimination. This is why we suggested that both non-mirror-image and mirror-image grating pairs are distinguished with respect to specific aspects of grating luminance profiles. Without referring to known receptive field properties of cortical cells, we have also indicated how the two processes of grating discrimination proposed could be related to receptive field sensitivities.

Several observations are supportive of Livingstone and Hubel's physiological interpretation of our findings. First, when mirror-image grating pairs were compared in extrafoveal vision the darker stripes were as clearly seen as in foveal vision. But discrimination of the pairs was impossible because the darker stripes lacked a precise positional relationship with their background. To the present author as a subject, these stripes appeared floating on the coarser gray striation. Livingstone and Hubel explain why visual resolution (as well as grating contrast sensitivity[4]) may be less reduced in peripheral vision than the processing of positional information. The apparent qualitative difference in handling form foveally and peripherally (our interpretation) could well result from such a difference in rates of deterioration with eccentricity. Second, further support for a re-